Pharmacology & Med Administration – Part 2

Georgia Office of EMS

EMT-I ➔ AEMT Upgrade

CT ➔ CT Update

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Medication Administration

Medication Administration

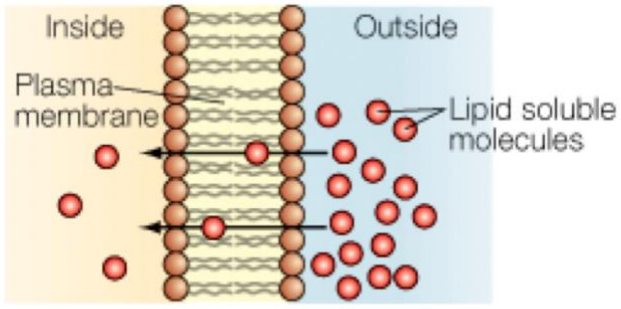
- Medical Direction
  - Medication administration is governed by local protocol
  - Some drugs may be given without on-line med control, other may require doctors orders
- AEMT responsibilities with drug orders
  - Confirm the "six rights" of medication administration
    - Right patient
    - Right drug
    - Right dose
    - Right route
    - Right time
    - Right documentation
- Specific Medications
  - You may be able to administer the following medications as an AEMT. Check with local prorocol
    - Oxygen, Oral Glucose, Glucagon IM, D_{50}, Epinephrine IM, Albuterol, Nitroglycerine, Nitrous Oxide, Narcan, Aspirin

Cell Physiology Review

- One of the basic functions of an AEMT is administering fluids
- Basic cell physiology provides an understanding of how administering fluids may help or harm an individual

Cell Physiology Review

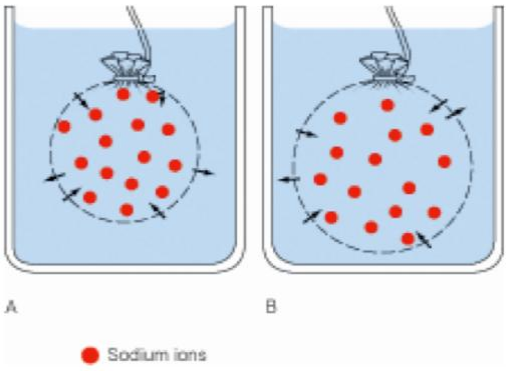
- A human cell is selectively permeable
  - Allows small compounds such as O_2, H^+, H_2O, and CO_2 to cross freely while other large compounds such as glucose need assistance
- Fluids and electrolytes move across the cell membrane to balance out each side
  - Diffusion is when a substance moves from an area of higher concentration to an area with lower (think of a drop of food coloring in a glass of water)
  - Filtration is another type of diffusion commonly used by the kidneys to clean blood (think of a coffee filter allowing water with the coffee flavor through but keeping the large particles out)
  - Active transport is a method used to transport substances against the concentration gradient using energy or ATP (Na^+/K^+ pump)
  - Osmosis occurs when there are different concentrations of a substance on either side of the membrane and an equal number of molecules are displaces from each side to equal out the concentration

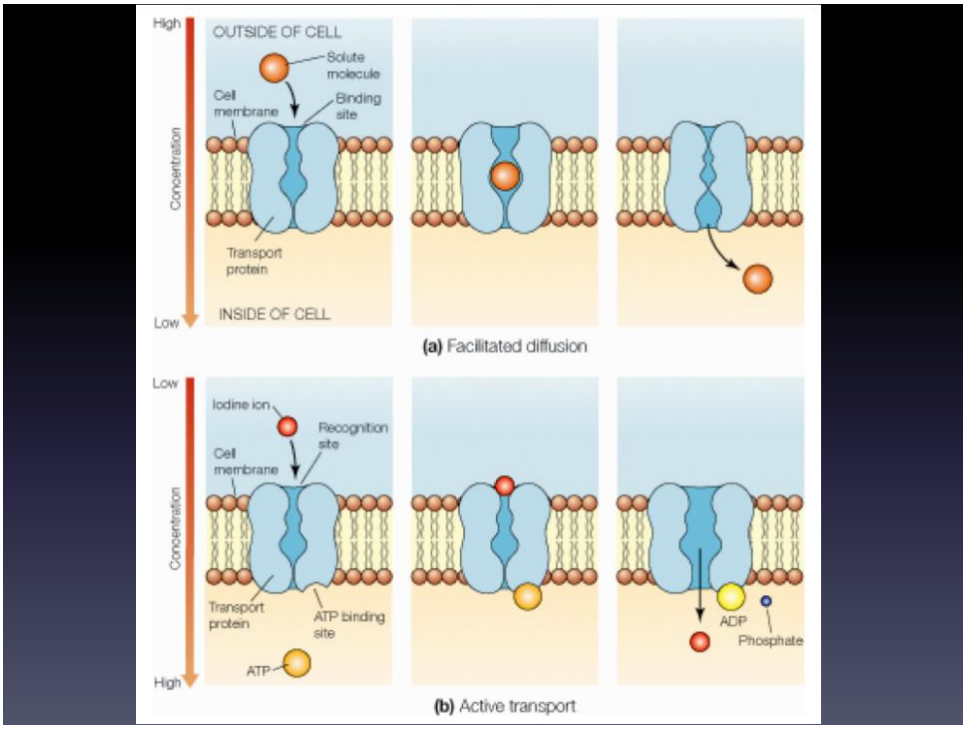


Simple diffusion

Diffusion

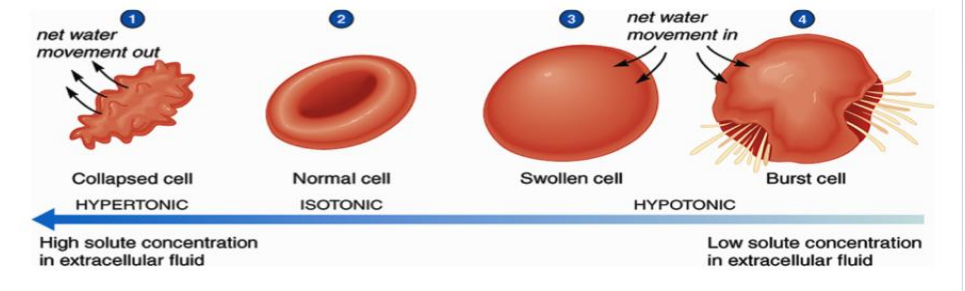
Osmosis





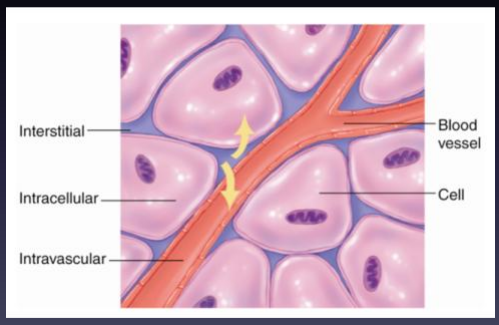
Tonicity

- Isotonic solutions have the same concentration of Na+ has does the cell
- Hypertonic solutions have a greater concentration of Na+ than does the cell
- Hypotonic solutions have less of a concentration of Na+ than does the cell



Fluid Compartments

- Intravascular – The water portion surrounding the blood cells
- Interstitial – Water outside the vascular compartment and between cells



Drug Calculations

Before understanding drug calculations, you must understand the basics of the metric system and volume/weight conversion

Table 8-5 Metric Units and Their Equivalents

Unit	Equivalent
Weight (smallest to largest)	
1 µg	0.001 mg
1 mg	1,000 µg
1 g	1,000 mg
1 kg	1,000 g
Volume (smallest to largest)	
1 mL	1 cc*
100 mL	1 dL
1,000 mL	1 L

*Cubic centimeters (cc) is a unit also used to represent milliliters (mL); therefore, 1 cc is the same as 1 mL (1 cc = 1 mL).

Table 8-4 Symbols Used in the Metric System

Unit	Symbol
Weight (smallest to largest)	
microgram	µg (or mcg)
milligram	mg
gram	g (or gm)
kilogram	kg
Volume (smallest to largest)	
milliliter	mL
deciliter	dL
liter	L

Drug Calculations

Volume Conversion

- You will be using liters and milliliters predominantly in EMS
- To convert, you will simply divide or multiply by 1,000 or move the decimal three places to the right or left
- When converting mL to L, divide the smaller unit (mL) by 1000, or move the decimal three spaces to the left
- Converting 1 L to mL
  - 1 L X 1000 = 1000 mL or 1 = 1000.
- Converting 100 mL to L
  - 100 mL/1000 = 0.1 L or 100. = 0.1L

Weight Conversion

- The primary units used in weight conversions are g, mg, and mcg.
- As with volume conversion, to convert a unit from a smaller unit to a larger unit divide by 1000, or move the decimal three places to the left
- Converting 200 mcg to mg
  - 200 mcg/1000 = 0.2 mg or 200.0 = 0.2
- Converting 2 g to mg
  - 2 X 1000 = 2000 or 2.000 = 2000

Drug Calculations

- Many drug dosages are in mg/kg
- To convert pounds to kilograms, divide the weight by 2.2
- Simple drip calculation

$$\frac{\text{Volume (in mL) X drip set}}{\text{Time in minutes}} = \frac{\text{gtt}}{\text{min}}$$

The doctor has order 250 mL to be administered over 90 min using a 15 gtt/min set

$$\frac{250 \text{ mL X } 15 \text{ gtt/min}}{90 \text{ min}} = 41.6 \text{ gtt/min}$$

Drug Calculations

- Calculating Medication Doses will be based upon three factors:
  - Desired Dose (the amount ordered to give)
  - Concentration of Drug on hand (the total weight of a drug contained in a specific volume)
    - Total weight of the drug/Total volume in mL
    - 30 mg of Epi in a 30mL vial has a concentration of 1 mg/mL
    - 25 g of Dextrose in 50mL has a concentration of 0.5 g/mL
  - Volume to be administered
    - Desired dose (mg)/Dose on hand (mg/mL) = Volume to be administered
    - Ensure that the desired does and dose on hand are in the same unit (mg/g/mcg)
    - Desired dose (12.5 g of D50)/Volume on hand (0.5 g/mL) = 25 mL or half of a 50 mL syringe
    - Desired dose (70 mg)/Volume on hand (100mg/5mL or 20mg/mL) = 3.5 mL

Drug Calculations

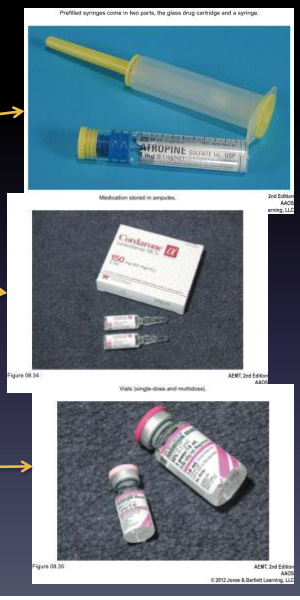
- Weight based drug dosages (1.5 mg/kg)
  - Step one is converting weight to kg (154 lb = 70kg
  - Step two is determining the desired dose (1.5 mg/kg X 70 kg = 105 mg)
  - Step three is determining the drugs concentration (100 mg/5 mL = 20 mg/mL)
  - Step four is determining the volume to be administered (105 mg/20 mg/mL = 5.25 mL)

Drug Administration

- Three methods of drug administration that will be discussed are intramuscular, subcutaneous, intranasal, and nebulized
- We will also discuss access medications from various forms of packaging such as ampules, vials, and prefilled syringes

Drug Administration

- Prefilled syringes come in tamper proof boxes and are separated into a glass container and a syringe
- Ampules are breakable glass containers that carry a single dose of a medication
- Vials may contain a single or multiple doses. They come in a glass or plastic container with a rubber stopper; some vials may include medications that must be reconstituted, such as glucagon



Drawing medication from an ampule

- Step 1: Check the medication to ensure proper drug, concentration and expiration; gently tap or shake the stem of the ampule to shake medication to the base
- Step 2: grip the base in one hand, and the stem in the other with a 4X4 and snap off the stem
- Step 3: insert the needle into the medication and draw the solution into the syringe
- Step 4: Holding the needle up, gently tap on the syringe to loosen air trapped inside
- Step 5: Gently press on the plunger to expel any air trapped inside

Drawing medication from an ampule

1. Check that you have the correct drug and the expiration date has not passed. Tap the ampule to shake the medication into the base.

Figure 08.SD03_1
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2. Grip the neck of the ampule using a 4" × 4" gauze pad and snap the neck off.

Figure 08.SD03_2
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Drawing medication from an ampule

3. Without touching the outer sides of the ampule, insert the needle into the medication in the ampule, and draw the solution in the syringe.

Figure 08.SD03_3

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4. Holding the syringe with the needle pointing up, gently tap the barrel to loosen air trapped inside.

Figure 08.SD03_4

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Drawing medication from an ampule

5. Gently press on the plunger to dispel any air bubbles, and if not using a needleless system, recap the needle using the one-handed method.

Figure 08.SD03_5

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Drawing medication from a vial

- Step 1: Check the medication to ensure proper drug, concentration, and expiration
- Step 2: Determine the amount of medication needed and draw that much air into the syringe
- Step 3: Invert the vial, insert the needle through the rubber stopper and expel the air in the syringe into the vial then release the plunger keeping the needle in the medication
- Step 4: Remove the needle and expel any air in the syringe

Drawing medication from a vial

1. Check the medication and its expiration date. Confirm that it is the correct drug and concentration, and that it is not discolored.

Figure 08.SD04_1

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2. Determine the amount of medication needed, and draw that amount of air into the syringe.

Figure 08.SD04_2

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Drawing medication from a vial

3. Invert the vial, and insert the needle through the rubber stopper. Expel the air in the syringe and release the plunger, keeping the tip of the needle within the medication.

Figure 08.SD04_3

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4. Withdraw the needle, and expel any air in the syringe.

Figure 08.SD04_4

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Drawing medication from a vial

5. Recap the needle using the one-handed method.

Figure 08.SD04_5

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Subcutaneous/ IM administration

- Step 1: BSI
- Step 2: Determine the need for the medication
- Step 3: Obtain Hx including allergies
- Step 4: Follow standing orders or medical control
- Step 5: Check the medication for cloudiness, expiration, and that it is the correct drug, concentration, and determine the appropriate dose
- Step 6: Advise the patient of the potential discomfort while explaining the procedure
- Step 7: Assemble and check the equipment needed
- Step 8: Cleanse area for administration using aseptic technique
- Step 9 (SC): Pinch the skin surrounding the area, advise the patient of a stick, insert the needle at a 45 degree angle
- Step 9 (IM): : Stretch the skin over the cleansed area, advise the patient of a stick and insert the needle at a 90 degree area
- Step 10: Pull back on the plunger to aspirate for blood. The presence of blood may indicate that you have entered a vein. Remove the needle, hold pressure over the site, and discard the needle. Select another site
- Step 11: If no blood is present, inject the medication and remove the needle. Immediately place it in the sharps
- Step 12: Rub the area in a circular motion
- Step 13: Store any unused medication properly
- Step 14: Monitor the patient's condition, and document the medication given, route, administration time, and patient response

Subcutaneous and Intramuscular Injection Sites

Common sites for subcutaneous injections. A. Upper part of the arm. B. Anterior part of the thigh. C. Abdomen.

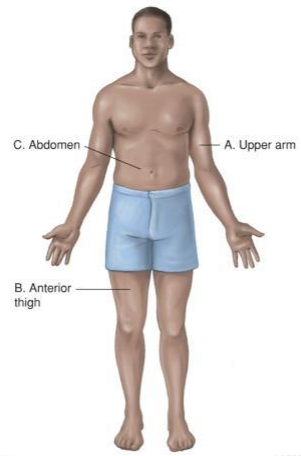

Figure 08.40

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Common sites for intramuscular injections. A. Deltoid muscles. B. Gluteal area. C. Vastus lateralis muscle. D. Rectus femoris muscle.

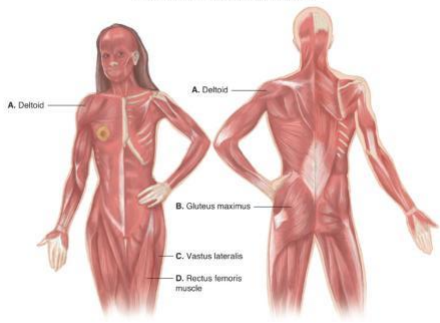

Figure 08.41

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Subcutaneous/Intramuscular Administration

1. Check the medication to be sure that it is the correct one, that it is not discolored, and that the expiration date has not passed.

Figure 08.SD05_1

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2. Assemble and check the equipment. Draw up the correct dose of medication.

Figure 08.SD05_2

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Subcutaneous/Intramuscular Administration

3. Using aseptic technique, cleanse the injection area.

Figure 08.SD05_3

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Subcutaneous/Intramuscular Administration

4. Pinch the skin and insert the needle at a 45° angle. Pull back on the plunger to aspirate for blood. If there is no blood, inject the medication.

Figure 08.SD05_4

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3. Stretch the skin over the area, and insert the needle at a 90° angle. Pull back on the plunger to aspirate for blood. If there is no blood, inject the medication.

Figure 08.SD06_3

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Subcutaneous/Intramuscular Administration

4. To disperse the medication, rub the area in a circular motion. Monitor the patient's condition.

Figure 08.SD06_4

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Intranasal administration

- Step 1: BSI
- Step 2: Determine the need for the medication
- Step 3: Obtain Hx including allergies
- Step 4: Follow standing orders or medical control
- Step 5: Check the medication for cloudiness, expiration, and that it is the correct drug, concentration, and determine the appropriate dose
- Step 6: Draw up the appropriate dose in the syringe
- Step 7: Attach the mucosal atomizer device to the syringe
- Step 8: Explain the procedure to the patient
- Step 9: Spray half of the medication into each nostril
- Step 10: Dispose of the syringe and atomizer in the appropriate container
- Step 11: Monitor the patient's condition, and document the medication given, route, administration time, and patient response

Atomizer

Mucosal atomizer device.

Figure 08.42
Courtesy of Wolfe Tory Medical, Inc.

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Administration by inhalation

- Many medications for respiratory emergencies are given via the inhalation route
  - Most common medication is oxygen
  - Other common medications include bronchodilators, nitrous oxide
- A patient with respiratory disease will usually have a metered dosed inhaler (MDI)
- Liquid medications may be administered in nebulizers

Administration by inhalation

Some medications are inhaled into the lungs with a metered-dose inhaler so that they can be absorbed into the bloodstream more quickly.

Figure 08.43

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A small-volume nebulizer is used to deliver medications via aerosolized mist.

Figure 08.44

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AEMT NEW MEDS

Pharmacological Intervention Skills	Levels	Interpretive Guidelines
3. Administration of medications/fluids		
a. Crystalloid IV solutions	I* A* C P	*This includes hypotonic, isotonic, and hypertonic solutions as approved by medical direction. This also includes combination solutions (i.e. D5LR, D5NS, etc.). EMT-Is are limited to the initiation of crystalloid solutions that do not have added pharmacological agents. AEMTs are limited to the initiation of crystalloid solutions that do not have added pharmacological agents.*
b. Administration of hypertonic dextrose solutions for hypoglycemia	I A C P	*Hypertonic dextrose solutions may be given IV/IO.*
c. Administration of glucagon for hypoglycemia	A C P	*Glucagon may be administered via IM, SC, IV, IO or intranasal routes as approved by the local EMS medical director.*
d. Administration of SL nitroglycerine to a patient experiencing chest pain of suspected ischemic origin	A C P	
e. Parenteral administration of epinephrine for anaphylaxis	E* I* A* C P	*EMTs may only administer epinephrine via an auto-injector. EMT-Is may only administer epinephrine via an auto-injector. AEMTs may prepare and administer epinephrine only via the IM and SC routes.*
f. Inhaled (nebulized) medications to patients with difficulty breathing and/or wheezing	E* I* A C P	*Inhaled (nebulized) means atomization of the medication through an oxygen/air delivery device with a medication chamber, or through use of a metered-dose inhaler. EMTs may only administer pre-measured unit doses of nebulized medications. EMT-Is may only administer pre-measured unit doses of nebulized medications.*
g. Administration of a narcotic antagonist to a patient suspected of narcotic overdose	A C P	*Administration may be via IM, SC, IV, IO, or Intranasal routes as approved by the local EMS medical director.*
h. Administration of nitrous oxide (50% nitrous oxide, 50% oxygen mix) for pain relief	A C P	
i. Vaccine administration	I* A* C* P	*EMT-Is, AEMTs and CTs are allowed to administer vaccinations only during designated events such as mass vaccination clinics or in the event of a declared public health emergency, and only after training through an OEMST training course.*
j. Paralytic administration	P*	*Administration of paralytics for the purposes of RSI (Rapid Sequence Induction/Intubation) is not permitted unless the EMS Agency has met RSI requirements promulgated by the OEMST, and has received approval for RSI use from the OEMST. Paramedics are allowed to use paralytics to maintain the paralysis of an already intubated patient, if approved by medical direction.*
k. Administration of other physician approved medications	C* P*	*CTs are only permitted to give the following: anti-arrhythmics, vagolytic agents, chronotropic agents, alkalizing agents, analgesic agents, and vasopressor agents. Paramedics are allowed to give any medication via any enteral or parenteral route, as approved by medical direction (see RSI note above).*
l. Maintain an infusion of blood or blood products	P	

Nitrous Oxide

- In the Georgia Scope of Practice for AEMTs and CTs

Nitrous Oxide

- 50% oxygen, 50% Nitrous
- Self-administered
- CNS Depressant
- Not as vasoactive as morphine

Nitrous Oxide

- Onset of Action: 2-5 minutes
- Duration of Action: 2-5 minutes
- Relatively immediate pain relief
- Estimated to be equivalent analgesic effect to 10-15 mg of morphine

Nitrous Oxide - Indications

- **Pain relief**
  - Extremity Trauma
  - Burns
  - Ischemic Chest Pain

Nitrous Oxide

- Contraindications:
  - Altered LOC
  - Head Injury
  - Decompression Sickness
  - Facial Trauma
  - Pneumothorax
  - Bowel obstruction
  - Hypoxic Patients

Nitrous Oxide – Administration

- Self administered
  - Till patient has relief of pain OR drops the mask

For More Information

- http://www.emsworld.com/article/10322118/prehospital-pharmacology-nitrous-oxide

Nitroglycerine

- Not a new drug for AEMTs, because EMT-Is could "assist" with it, but AEMTs are now allowed to "administer" it.
- From the Georgia Scope:
  - "Administration of SL nitroglycerine to a patient experiencing chest pain of suspected ischemic origin"

Nitroglycerine

- FOR AEMTs – ONLY permitted to give NTG for ischemic type chest pain

Glucagon

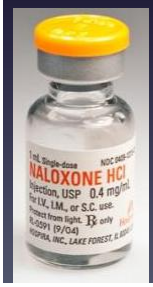
- Hormone
  - Causes the liver to break down stored glycogen into glucose → raises blood sugar
  - If the patient is malnourished, this will not work
- For AEMTs – it can only be given for hypoglycemia.
  - From Georgia Scope: "Administration of glucagon for hypoglycemia"

Glucagon

- Must be reconstituted
- Usual dose: 1 mg – can be given IV/IM/SC/IO
- Only given if can't get an IV

Narcan

- Indications:
  - Respiratory depression from suspected narcotic OD
- Contraindications:
  - Relative
- Dosage:
  - Consult medical direction
  - IM/IV/SC/IN



Epinephrine

- EMT-Is have been allowed to give via auto-injector before
- AEMTs now permitted to give via IM/SC routes (draw it up)
  - ***ONLY FOR ANAPHYLAXIS***
  - ***NOT VIA THE IV ROUTE!!!!***

Epinephrine

- 1:1000 (1 mg/mL)
- Usual dose:
  - Adult: 0.3 – 0.5 mg (0.3-0.5 mL)
  - Pediatric: 0.15 – 0.25 mg (0.15 – 0.25 mL)

Thank you!